

VARIABLE ANGLE LAUNCHER COMPLEX,

VARIABLE ANGLE LAUNCHER

(Bldg. No. 42115)

California State Highway 39 at the Morris Reservoir

Morris Test Facility

Angeles National Forest

Azuza Vicinity

Los Angeles County

California

HAER NO. CA-169-A

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PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD

National Park Service

Western Region

Department of the Interior

San Francisco, California 94107

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HISTORIC AMERICAN ENGINEERING RECORD
VARIABLE ANGLE LAUNCHER COMPLEX
VARIABLE ANGLE LAUNCHER (BUILDING NO. 42115)
(VAL)
HAER NO. CA-169-A

Location: State Highway 39, four miles north of Azuza and twenty miles east of Pasadena, at the Morris Dam Reservoir, in the Angeles National Forest, County of Los Angeles, California.

USGS Azuza and Glendora Quadrangles, Universal Transverse Mercator Coordinates: Zone 11.

Present Owner: U.S. Department of the Navy
Naval Command, Control and Ocean
Surveillance Center
RDT&E Division
Naval Research and Development
San Diego, CA 92152-5000

Present Use: Vacant, former naval testing facility to be demolished and the site returned to its natural state (estimated date 1996).

Significance: Morris Dam Test Facility (MDTF) was built at the Morris Dam Reservoir for the purpose of obtaining basic hydrodynamic data for use in design and development of Naval Ordnance, particularly air-to-water projectiles. The Variable-Angle Launcher (VAL) and its predecessor, the Fixed-Angle Launcher (FAL) were a consolidated effort between the scientific and military research and development communities. The VAL was the only structure in the nation where full scale, air launched projectiles could be tested at high velocities and variable entry angles into a body of water. MDTF served as a valuable resource during WWII and the Cold War era, spanning over 50 years. This is a unique complex where the setting has been unaltered by major modern development. The design is unique and all of its material is original. The components exhibit high quality, professional workmanship typical of contemporary naval military facilities. The facility has retained its overall feeling and appearance from the Cold War Era maintaining a strong sense of time and place.

Date: April 7, 1995

PART I. HISTORICAL INFORMATION

A. Physical History

1. **Date of Erection:** In the early 1940's, the concept of a full scale Variable-Angle Launcher was first discussed by the engineers at the California Institute of Technology. In October of 1945, this concept was to become a reality when the United States Navy approved funds for construction. The Underwater Ordnance Section of the Naval Ordnance Test Station, Inyokern, was in charge of the design. The planning and design of the Variable-Angle Launcher commenced during the later part of 1945. The Bureau of Ordnance, United States Navy, directed the General Tire and Rubber Company of California to construct the Variable-Angle Launcher on 25 January 1946. Construction began in April of 1946. The formal dedication and first launch occurred on 7 May 1948. Construction, with the exception of some instrumentation, was completed in September of 1948.
2. **Design:** The design of the Variable-Angle Launcher was the responsibility of the Development Engineering Section of the Underwater Ordnance Division of the United States Naval Ordnance Test Station, China Lake, California (Pasadena Area). W.H. Saylor, Head of Underwater Ordnance Division, and J.H. Jennison, Chief Engineer, were in charge of the design. Consultants employed on the project included: Coast Marine Engineering Company; F.J. Converse, Consulting Foundation Engineer; Frank G. Denison, Jr., Naval Architect; V.P. Pentegoff, Consulting Geologist; Quinton Engineers, LTD.; and N.D. Whitman, Jr., Consulting Structural Engineer.

J.H. Jennison and F.C. Lindvall were the two main figures involved with the design. The bronze dedication plaque, affixed to the Variable-Angle Launcher in 1948, reads "Designed by the staff of the Underwater Ordnance Division". Listed below this heading are: W.H. Saylor, Head Underwater Ordnance Division; J.H. Wayland, Chief Physicist; F.C. Lindvall, Consulting Engineer; and J.H. Jennison, Chief Engineer.
3. **Owners, Occupants and Uses:** The Morris Dam Test Facility is situated on land owned by the Metropolitan Water District of Southern California and the United States Forest Service. In 1941, the California Institute of Technology, working under a contract with the Office of Scientific Research and Development, began work at the Morris Dam Reservoir testing United States Naval ballistics during World War II. No record of agreement for use of the land has been found for the early 1940's.

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Post World War II, in July of 1945, Navy Command William Keighley took command of the Morris Dam Test Facility from F.C. Lindvall of the California Institute of Technology. On 1 September 1945, the United States Navy formerly transferred the Morris Dam Test Facility to Naval Ordnance Test Station, China Lake, California. The only known record of agreement for use of the land is dated 4 February 1947. The United States Navy under a Special Use Permit leased 20 acres of land from the United States Forest Service for the purpose of "construction research and operation of experimental equipment for naval ordnance research work."

Morris Dam Test Facility has been the only use of this land since the early 1940's. Numerous command changes have occurred over the fifty year span of the facility but the essential use did not change. This facility was a testing range for a variety of military ballistics. The Variable-Angle Launcher was built to perform full scale, air-to-water projectile firings at variable angles.

4. **Contractor:** The General Tire and Rubber Company of California was the prime contractor for the construction of the Variable-Angle Launcher. J.E. Keenan was the Engineer in Charge. Major sub-contracts were awarded to the United Concrete Pipe Corporation for steel structures and Norman I. Fader Company for concrete structures. The American Society of Civil Engineers published four papers in their "Journal of the Construction Division" in August of 1957. The papers discussed the design and construction of the VAL. Acknowledgment of the design and construction teams were also included.
5. **Original Plans and Construction:** The construction was under the jurisdiction of the Bureau of Yards and Docks of the United States Navy with Captain H.L. Matthews acting as Officer in Charge of Construction and Commander C.E. Langjois as Resident Officer in Charge of Construction.

The Variable-Angle Launcher was built at a cost of approximately two million dollars. The concrete and steel structure transverses a steep peninsula that juts into the Morris Dam Reservoir. The "A" frame structure measures approximately 260 in length (at the base) and 100 feet in height from its lowest point to the peak where it tapers to a length of 40 feet. A tower rises 48 feet above the top of the concrete "A" frame structure. The design is purely functional with clean and simple lines. The exterior surfaces are exposed concrete. The interior surfaces are painted concrete. Cantilevered balconies provide access to the upper deck levels of the concrete structure. The architectural effect is that of a ship's conning tower.

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The launcher bridge extends off one site with the counterweight ramp and car on the opposite site. The launcher bridge is a 300 foot long welded structure that spans between the concrete launcher ramp and two floating barges on the reservoir. The bridge may be raised or lowered from 10 to 40 degrees for projectile launchings.

Numerous drawings exist showing the site plan, building plan, building section and elevations for the Variable-Angle Launcher. Originals, sepias of originals, and an entire collection of blueprints are currently held by the Naval Research and Development Archives. Drawing also includes site perspectives, other buildings located at the Morris Dam Test Facilities, and numerous detail sheets. The originals, prints and sepias are generally in very good condition.

6. **Alterations:** The building exists almost exactly as it was built nearly fifty years ago. Other than routine maintenance items, such as painting or replacing worn mechanical pieces, the structure has changed very little over the years. The building's materials are all original and in good shape.

The only major alteration to the Variable-Angle Launcher was the addition of the second launching tube in 1953. This 32 inch diameter launching tube was added to the launching bridge adjacent to the existing 22½ inch diameter tube. The "Y" joint connecting the compression tank to the existing tube was modified to also service the new launching tube. A second projectile loader was also added at the bridge support carriage upper platform. Additional instrumentation and electrical support completed the second launching tube addition.

B. Historical Context

The Angeles National Forest was created in 1892, originally named the San Gabriel Timberland Reserve. This was the first area set aside in California after the passage of the Forest Reserve Act of 1891. The primary goal of this act was the conservation of watershed. During the 1920's and 1930's, several initiatives were undertaken to control the flow of the San Gabriel River and conserve its water resources. The City of Pasadena built Pine Canyon Dam (later renamed Morris Dam after Engineer Samuel B. Morris) to provide water retention for domestic use. Construction began in 1932 and was completed in 1934.

Morris Dam Test Facility was established seven year later in 1941 by the Engineers at the California Institute of Technology under the direction of F.C. Lindvall. The history of this facility is linked to the research and development efforts in the field of underwater ordnance during World War II and up to the early 1990's. The Variable-Angle Launcher

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was built after World War II during the early years of the Cold War Era. The United States Navy realized the substantial contribution made by the research and development work done at Morris Dam Test Facility and its effect on the outcome of battles during World War II. The Variable-Angle Launcher was built to test and develop new ordinance for the newly developed jet aircraft.

The Variable-Angle Launcher is a unique structure and the only structure where full scale, air launched projectiles could be tested at high velocities and variable entry angles into a body of water. The 300 foot long steel launching bridge was the longest all-welded steel spanning structure built in the United States at that time. (Refer to the HAER Documentation for the Morris Dam Test Facility for more information.)

PART II. ARCHITECTURAL INFORMATION

A. General Statement

In 1995, the building retains its overall feeling and appearance from the Cold War Era maintaining a strong sense of time and place. The original materials of concrete and steel are in good condition. The design is purely functional expressing very clean and simple lines. The building appears much as it did nearly fifty years ago when it was constructed.

1. **Architectural Character:** An expressly functional design of the building depicts no architectural period or style. However, the concrete form with cantilevered walkways and camera tower above produces an architectural effect of a ship's conning tower and a distinct naval feeling.
2. **Condition of the Fabric:** Overall condition of the building's fabric is very good for a structure nearly fifty years old. The exposed concrete walls show slight signs of weathering. Major cracking in the concrete is visible in only one area above the roadway arch near the only expansion joint in the structure. The steel components are in excellent shape and show little or no sign of rust or stress cracks.

B. Description of Exterior

1. **Overall Dimensions:**
 - a. The "A" frame structure measures approximately 260 feet at the base (in length) and 100 feet (in height) from its lowest point to the peak where it tapers to a length of 40 feet. Additionally, a 48 foot tall tower extends above the top of the concrete "A" frame structure.
 - b. The launcher ramp measures 37 feet 9 inches wide by 332 feet long.
 - c. The counterweight ramp measures 19 feet 10 inches wide by 352 feet long.
2. **Foundation:** Combination of reinforced concrete slab on grade and continuous reinforced concrete footings.
3. **Walls:** Reinforced, cast-in-place, concrete walls varying from 10 inches, 12 inches, 18 inches to 24 inches thick.

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4. **Structural System:** Two different structural systems are used independent of each other.
 - a. Cast-in-place, reinforced concrete walls, floors, ceilings and stairs.
 - b. Welded steel "I" beam bridge structure and welded steel plates.
5. **Openings:**
 - a. Doors: Standard size wood and metal doors with a 12 inch by 12 inch lite typical at most doors.
 - b. Windows: Standard wood and metal frame windows.

C. **Site**

1. **General Setting and Organization:** Transversing a steep peninsula that juts into the Morris Dam Reservoir, the Variable-Angle Launcher is oriented with its main axis in the northeast-southwest direction. Located in the San Gabriel Canyon, part of the San Gabriel Mountains, in the Angeles National Forest, the site is approached by a four mile long moderate climb out of Azuza on State Highway 39.

PART III. SOURCES OF INFORMATION

A. Architectural Drawings

1. United States Department of the Navy
Naval Command Control and Ocean Surveillance Center
Naval Research and Development, RTD&E Division
San Diego, California
 - a. Originals, sepias and bluelines dating from the mid-1940's up to the 1990's are located at the "Archive Room", Building 341, Room 129.

B. Historical Photographs

1. United States Department of the Navy
Naval Command Control and Ocean Surveillance Center
Naval Research and Development, RTD&E Division
San Diego, California
 - a. Historical photographs and negatives are located at the Photograph/Multimedia Branch, Building 347.
2. Dave Willis, Personnel Collection
Naval Command Control and Ocean Surveillance Center
Naval Research and Development, RTD&E Division
San Diego, California
 - a. Historical photographs and negatives currently at Building 341, Room 110.

C. Interviews

1. Dave Willis, 1 February 1995 at the Morris Dam Test Facility, Azusa, California.
 - a. Dave Willis is the facility manager of Morris Dam Test Facility.
2. Randy Peacock, December 1994 through January 1995 at Naval Research and Development, Building 341, Room 129.
 - a. Randy Peacock is the Naval Research and Development Archivist and former employee at the Morris Dam Test Facility.

D. Bibliography

1. Primary and Unpublished Sources

a. Reports

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2. Jennison, James H. "The Variable-Angle Launcher for Air-to-Water Missiles." 15 May 1950. (NAVORD Report 1180 (NOTS 236) Prepared for U.S. Naval Ordnance Test Station, Inyokern, California, Pasadena Annex currently located in archives of Naval Research and Development, San Diego, California).
3. Naval Ocean System Center. "Variable-Angle Launcher Naval Ocean System Center Morris Dam. Operating Procedures and Maintenance." No date. (Prepared for Naval Ocean System Center currently located in archives of Naval Research and Development, San Diego, California).
4. Naval Undersea Center. "Morris Dam Test Range". 31 July 1973. (Prepared for Naval Undersea Center, Report No. NUC TN 1109, currently located in archives of Naval Research and Development, San Diego, California).
5. Smith, J.A. "Design and Construction of the Variable-Angle Launcher". 16 January 1952. (NAVORD Report 1327 (NOTS 405) prepared for U.S. Naval Ordnance Test Station, Inyokern, China Lake, California currently located in archives of Naval Research and Development, San Diego, California).

b. Journals

1. Cox, John L. "Variable-Angle Launcher: A Naval Ordnance Testing Facility." August 1957. (Originally from "Journal of the Construction Division", proceedings of the American Society of Civil Engineers, currently located in archives of Naval Research and Development, San Diego, California).

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2. Jennison, James H. "Variable-Angle Launcher: Concrete Structures and Foundation Treatment." August 1957. (Originally from "Journal of the Construction Division", proceedings of the American Society of Civil Engineers, currently located in archives of Naval Research and Development, San Diego, California).
3. Whitman, N.D., Jr. "Variable-Angle Launcher: Steel Construction" August 1957. (Originally from "Journal of the Construction Division", proceedings of the American Society of Civil Engineers, currently located in archives of Naval Research and Development, San Diego, California).
4. Carlisle, F.L. "Variable-Angle Launcher: Mechanical and Electrical Features." August 1957. (Originally from "Journal of the Construction Division", proceedings of the American Society of Civil Engineers, currently located in archives of Naval Research and Development, San Diego, California).
5. Bravo, Arthur C. "Variable-Angle Launcher: Construction." August 1957. (Originally from "Journal of the Construction Division", proceedings of the American Society of Civil Engineers, currently located in archives of Naval Research and Development, San Diego, California).

2. Secondary and Published Sources

a. Reports

1. Christman, Albert B. Sailors, Scientists and Rockets: Origins of the Navy Rocket Program and of the Naval Ordnance Test Station, Inyokern. 1971. (Naval History Division, Washington).
2. Gerrard-Gough, J.D. and Christman, Albert B. The Grand Experiment at Inyokern: Narrative of the Naval Ordnance Test Station During the Second World War and the Immediate Postwar Years. 1978. (Naval History Division, Washington).
3. Hovde, F.L. Rocket and Underwater Ordnance: Summary Technical Report of Division 3, NDRC, Volume 1. 1946. (Office of Scientific Research and Development, Washington D.C. on file at California Institute of Technology Aeronautics Library, Pasadena).

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4. Lindvall, F.C. "Aircraft Torpedo Development and Testing". In Rocket and Underwater Ordnance: Summary Technical Report of Division 3, NDRC Volume 1. 1946. (Office of Scientific Research and Development, Washington, D.C. On File at California Institute of Technology Aeronautics Library, Pasadena).
5. Lindvall, F.C. "Facilities and Instrumentation for Study of Torpedo Entry." In Rocket and Underwater Ordnance: Summary Technical Report of Division 3, NDRC Volume 1. 1946. (Office of Scientific Research and Development, Washington, D.C. On File at California Institute of Technology Aeronautics Library, Pasadena).
6. Lindvall, F.C. Aircraft Torpedo Development and Water Entry Ballistics. A final technical report of Office of Scientific Research and Development Contract OEMsr-418. 1946. (California Institute of Technology, Pasadena. On file at California Institute of Technology Aeronautics Library, Pasadena).
7. Mason, Dr. Max. "Antisubmarine Weapons and Underwater Ballistics." In Rocket and Underwater Ordnance: Summary Technical Report of Division 3, NDRC Volume 1. 1946. (Office of Scientific Research and Development, Washington, D.C. On file at California Institute of Technology Aeronautics Library, Pasadena).
8. Mason, Dr. Max. Water Entry and Underwater Ballistics of Projectiles. A Final Technical Report of Office of Scientific Research and Development Contract OEMsr-418. 1946. (California Institute of Technology, Pasadena. On file at California Institute of Technology Aeronautics Library, Pasadena).
9. Stephens, John F. Data Reduction and Analysis Procedures for Variable-Angle Launcher Tests. Report for U.S. Naval Undersea Warfare Center, Pasadena by Associated Aero Science Laboratories, Inc. Pasadena. 1968. (On file at Naval Research and Development Engineering Division, San Diego, California).

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b. Records

1. U.S. Navy. VAL Launching Records. 1950-1951. Variable-Angle Launcher Test Firing Record Ledger. (On file at Naval Research and Development Engineering Division, San Diego, California).
2. U.S. Navy. VAL Data Sheets. 1959-1975. Variable-Angle Launcher Test Firing Record Ledger. (On file at Naval Research and Development Engineering Division, San Diego, California).

E. Likely Sources for Further Information

1. Naval Research and Development (NRaD) Topside Library, San Diego, California.
2. Naval Research and Development (NRaD) Photo Lab-Topside Library, San Diego, California.
3. Naval Research and Development (NRaD) Engineering Division Archives, San Diego, California.
4. California Institute of Technology Aeronautics Library, Pasadena, California.
5. Naval Ordnance Test Station (NOTS) Inyokern, China Lake, California.
6. Defense Technical Information Center (DTIC).
7. United States Naval Archives, Washington, D.C.

PART IV. PROJECT INFORMATION

The historic recordation of the Variable-Angle Launcher is a mitigative recording required by the Memorandum of Agreement between the United States Department of the Navy, the United States Forest Service, California State Historic Preservation Office and the Advisory Council on Historic Preservation prior to the demolition of the Morris Dam Test Facility. Captain Kirk Evans, Commanding Officer, Naval Command, Control and Ocean Surveillance Center (NCCOSC), Research, Development, Test and Evaluation (RDT&E) Division signed the Memorandum of Agreement on 21 September 1994. Mr. Donald Lydy, NCCOSC, RDT&E Division is the Cultural Resource Manager for the project.

This documentation was prepared by the office of Architect Milford Wayne Donaldson, FAIA, Inc. and project architect Brian S. Rickling. The following individuals provided help and information during the researching of this project: Dave Willis, Morris Dam Facilities Manager (NRaD); Randy Peacock, Engineering Technician-Drawing Archives (NRaD); San Corrao, Engineer-in-Charge (NRaD); Don Lydy, Facilities Manager (NRaD); Fred Dawson, Photo/Multimedia Branch (NRaD); Frances Garrison, Photo Lab Librarian (NRaD).